Watershed Modeling and GIS

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China/U.S. Water Resources Workshop

ARS Modeling Strengths

- National Network of Scientists
  - Wide Range of Processes
  - Build Comprehensive Models
- ARS Experimental Watersheds
  - Valuable Source of Data for Models
- Simulation of Agricultural Management
- Relationships with Farmers/Watershed Stakeholders

History of ARS Watershed Modeling

1950's--1960's	USLE - Universal Soil Loss Equation
1970's	CREAMS - Chemicals, Runoff, Erosion, from Ag Management Systems
1980's	Advanced Field Scale Management Models - Small Watershed Models
1990's	Hillslope Processes - Large Watershed River Basin Models

USDA Modeling Efforts Watershed/River Basin

- Kineros - Distributed Rainfall-Runoff Erosion Model
- AGNPS98 - Watershed System
- Riparian Ecosystem Management Model
- SWAT - River Basin Scale

SWAT Model Description

- River Basin Scale - 100 - 1000's mi^2
- Continuous time - Daily Time Step
- Basin Discretization - Grid Cell, Subwatershed
- Stream and Pond/Reservoir Routing

SWAT Model Description

- Land Management - Cropping Systems, Tillage, Nutrients, Pesticides, Irrigation
- Water Management - Water Use, Stream and Reservoir Withdrawals, Water Transfer
- Accepts Measured Data and Output from EPIC/APEX

Components

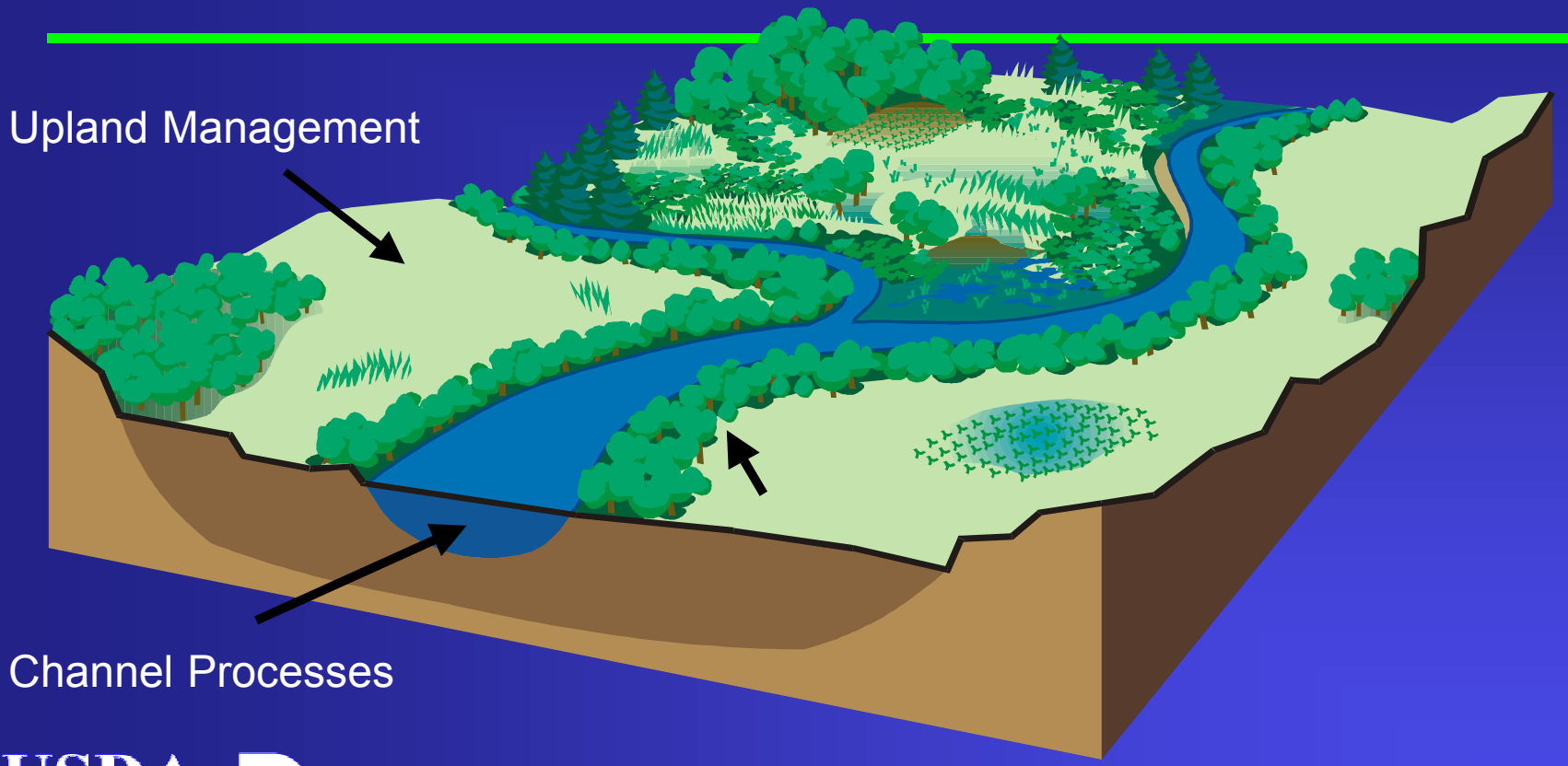
Subbasin

- Weather
- Hydrology
- Sedimentation
- Crop Growth
- Nutrient Cycling
- Pesticide Dynamics
- Soil Temperature
- Management
- Impoundments

Routing

- Channel Flood Routing
- Channel Sediment Routing
- Channel Water Quality
- Pond/Reservoir Sedimentation and Water Quality

SWAT Watershed System



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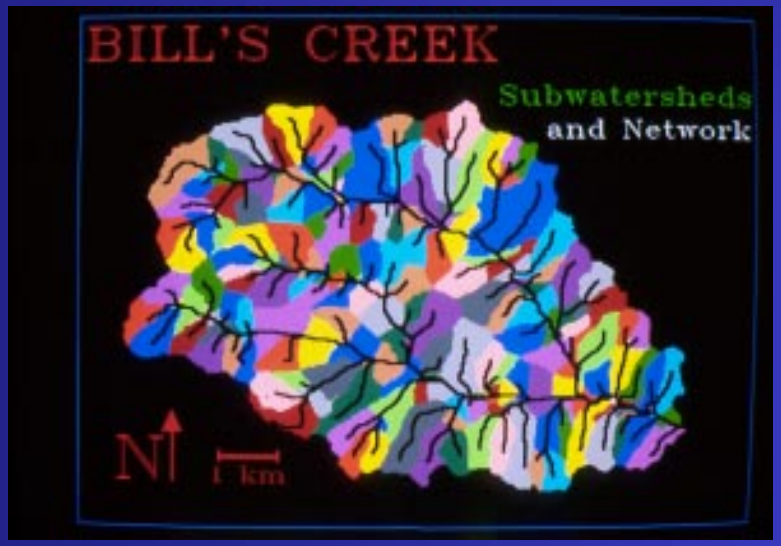
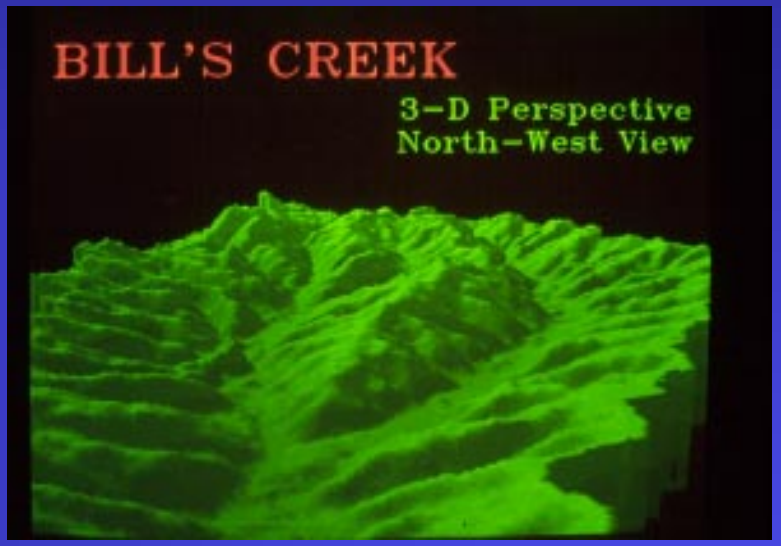
Geographic Information Systems

Tool (software) used to collect, analyze and display spatial data



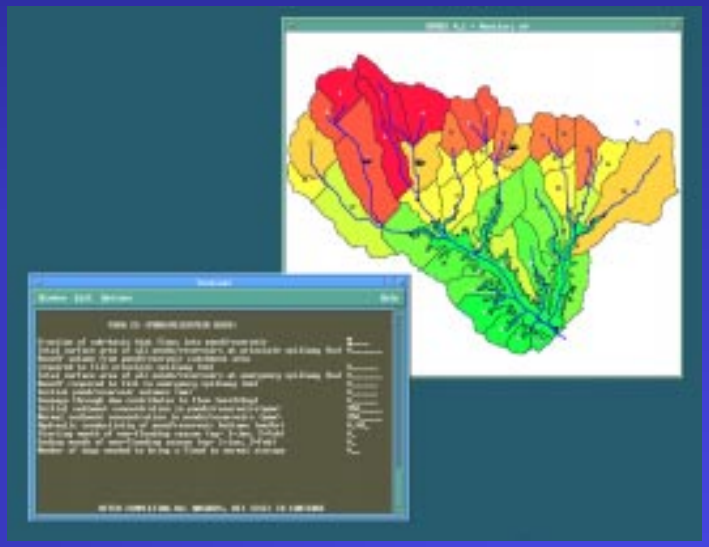


GIS Interfaces for Watershed Models

- Spatially Distributed Models Require Significant Input and Generate Large Quantities of Output
- Powerful Tool for Subwatershed Delineation
- Automatic - Assembly and Format Model Inputs for Weather, Soils, Land Use, and Routing Configuration

SWAT GRASS Interface

- UNIX and Windows 95/NT
- Operational for Several Years
- Interface Used for HUMUS



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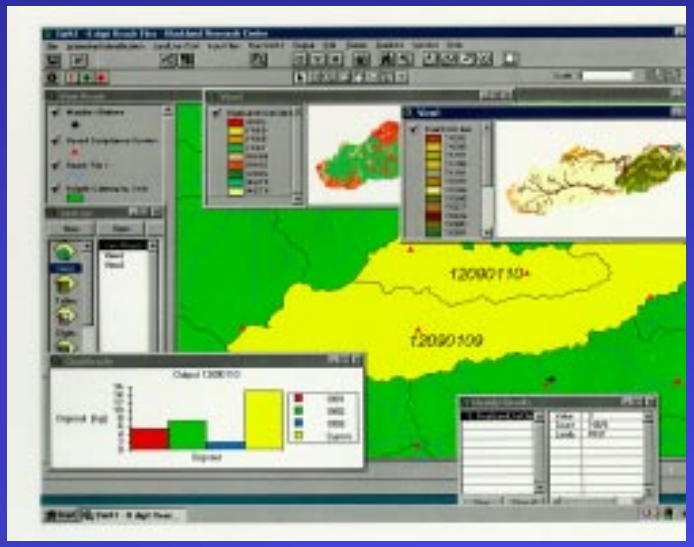
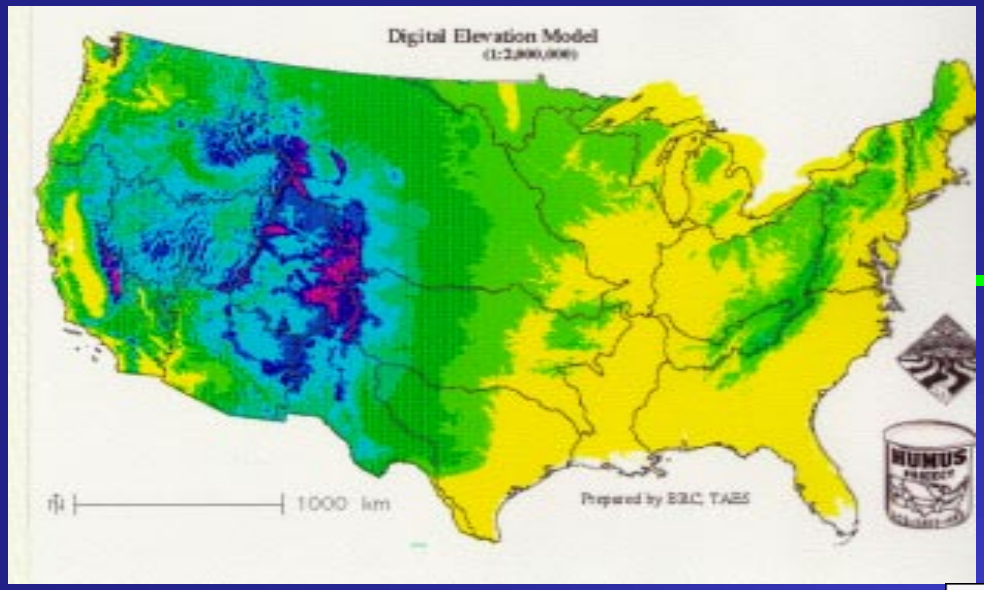
ArcView GIS Interface

- Windows 95/NT
- Operational but Still Under Development
- Incorporation into EPA Basins Interface in Fall, 1999 - for TMDL Analysis



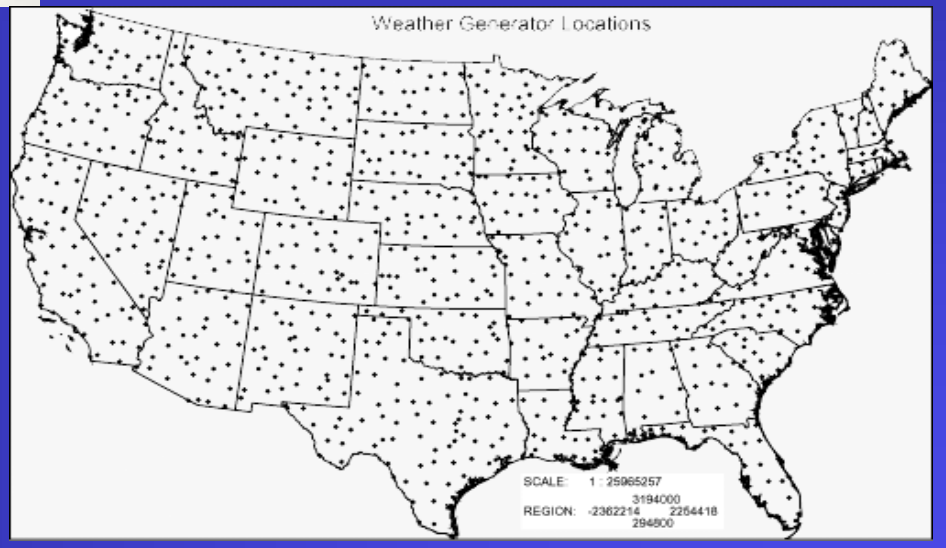
HUMUS
Hydrologic Unit Model of the U.S.

- NRCS - ARS - Texas A & M
- Resource Conservation Appraisal (RCA)
- National Water Resource Assessment
- Simulate Streamflow and Sediment in all U.S. River Basins



Digital Elevation Map 1:100,000 Scale

Weather Generator Stations (1,100)



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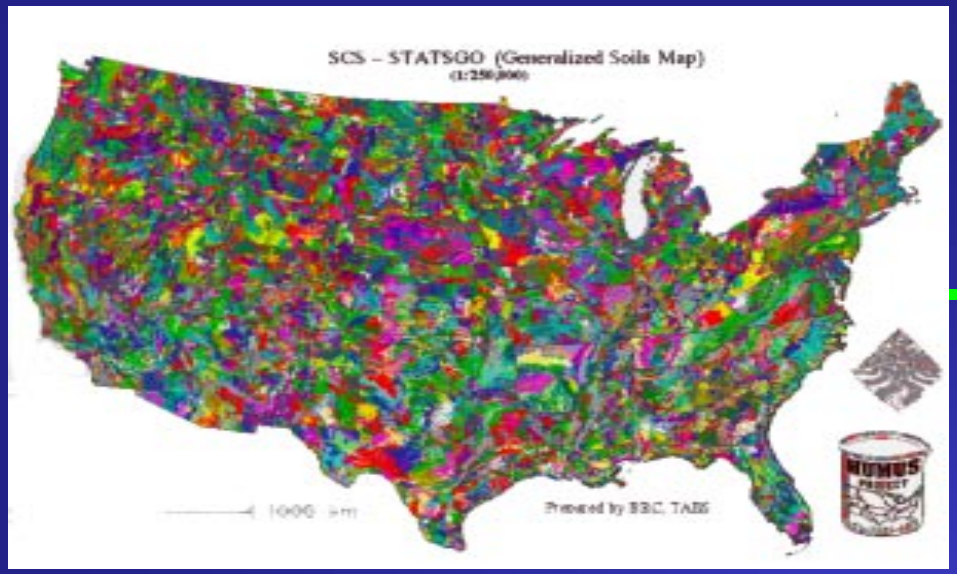
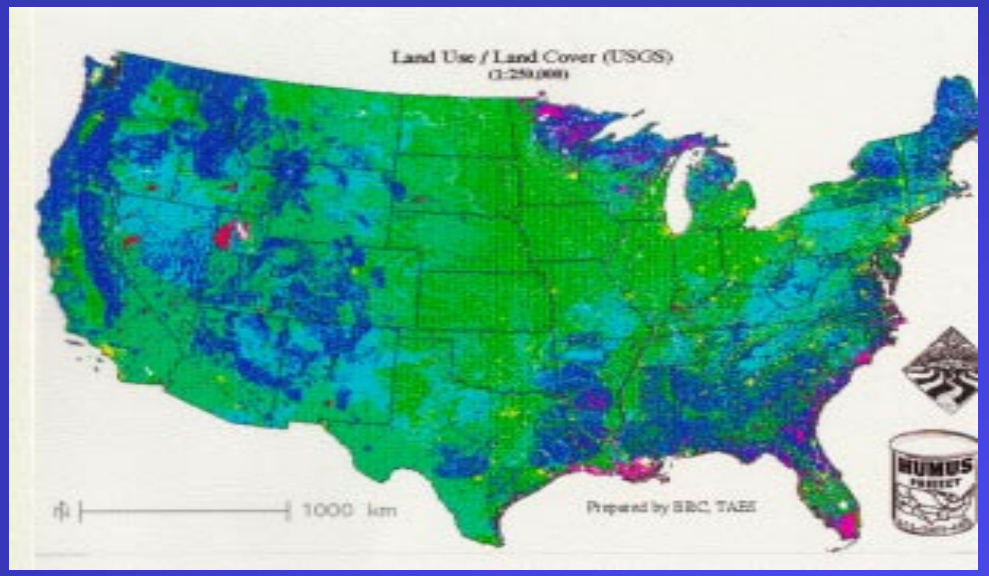
HUMUS
Hydrologic Unit Model of the U.S.

- HUMUS System - SWAT, GIS, Databases
- Calibration/Validation
  - 360 USGS Stations - Monthly Flow
- Scenarios
  - Water Use
  - Tillage Trends
  - Fertilizer and Animal Waste



STATSGO Soil Associations



Land Use/Land Cover

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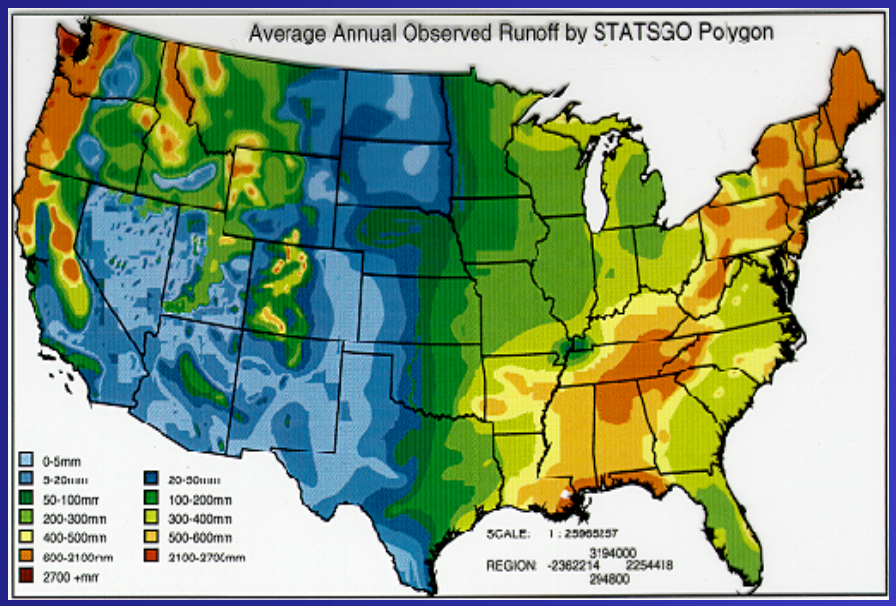
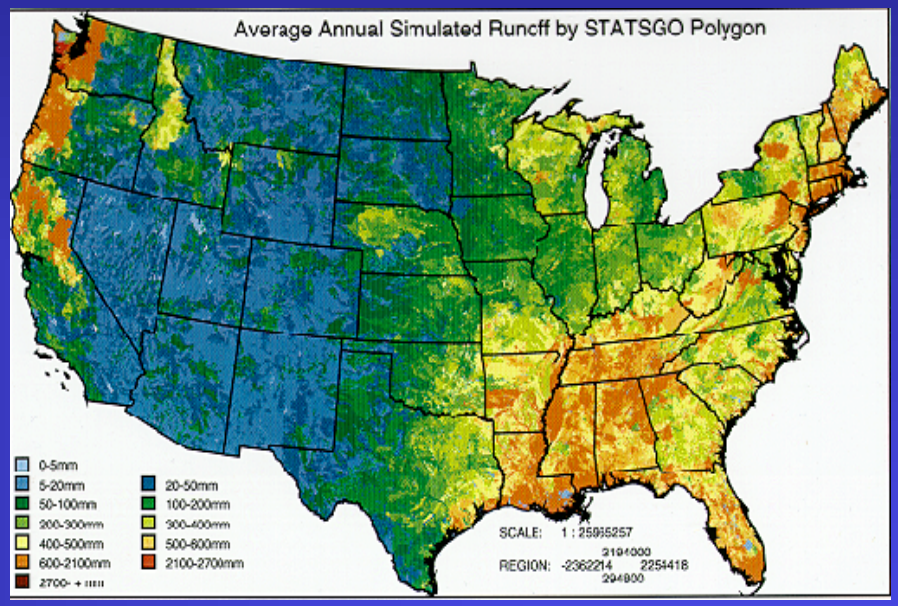
HUMUS
Measured and Simulated Streamflow





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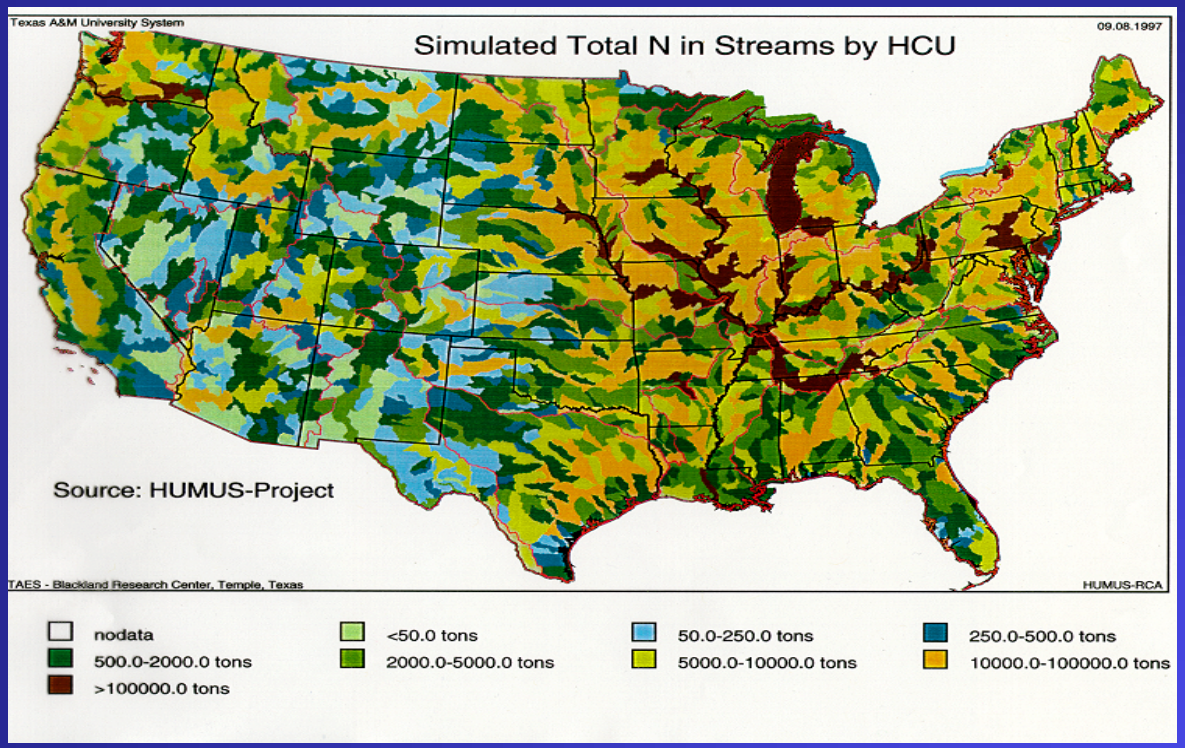
HUMUS
Total N in Streams



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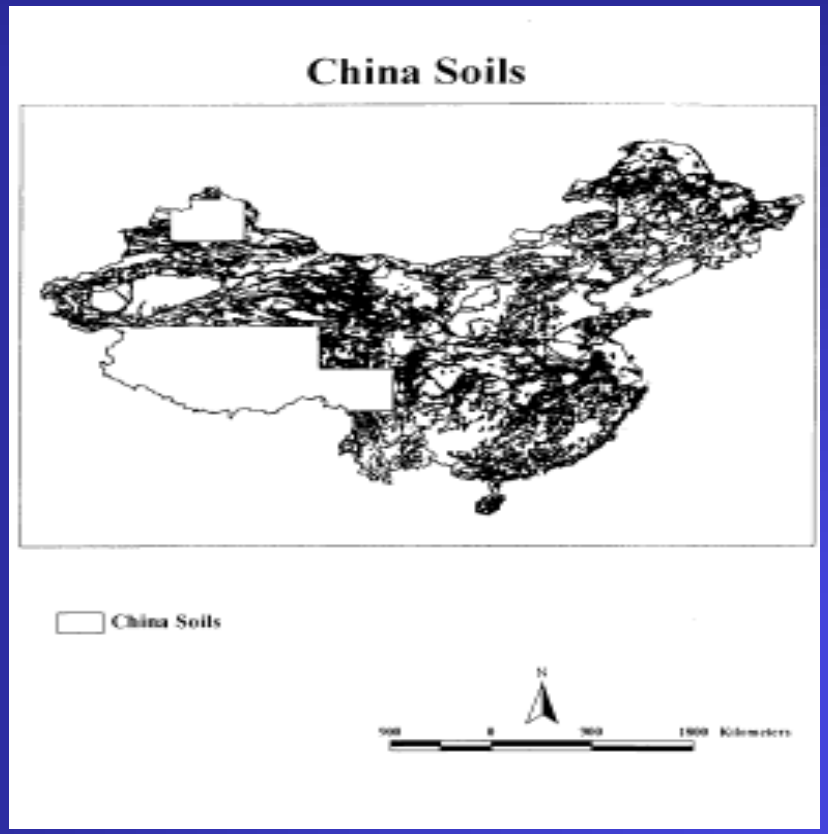
China - Data Available for Regional Water Resource Assessment

- WMO Climate - Daily Prec and Max/Min Temp 600+ Stations - 1977-1998
- Soils - 1:1,000,000 U.S. Taxonomic Classification
- Topography - USGS 1 km^2 Dem of World
- Land Use - AVHRR

China Soils



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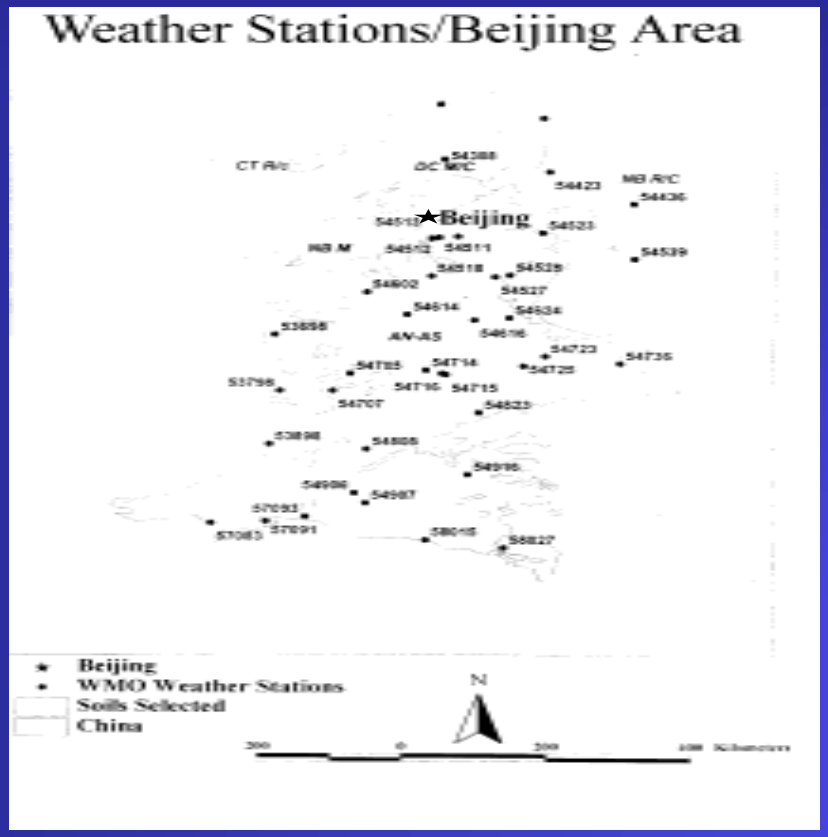
China
Current Collaboration

- EPIC - FAS Wheat Production
- SWAT - Chinese held SWAT Training
  - Scientist from each Province
  - Converted SWAT to Chinese



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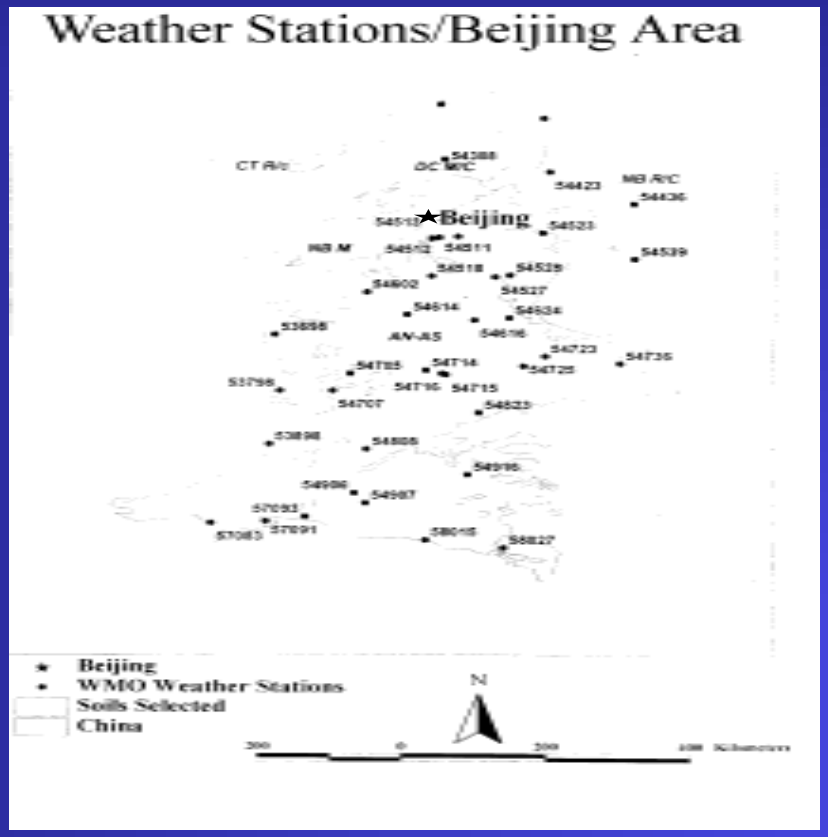
Weather Stations/Beijing Area



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Future of ARS Watershed Modeling

- Continued Research on Watershed Processes
  - Macropore Flow, Crusting, Pesticides/Nutrients
  - Buffer/Riparian, Surface/Subsurface
  - Interactions, Bacteria
- Improve Coordinating of Comprehensive Model
  - Building
- GIS/Visualization Tools
- Remotely Sensed Data Including NEXRAD
- Linking Processes - Surface/Subsurface,
  - Loadings/Instream Quality

USDA
Non Point Source Watershed Modeling

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